EFFECT OF MOODLE BASED INSTRUCTIONAL MATERIAL IN ARTIFICIAL INTELLIGENCE COURSE ON DIGITAL FLUENCY, TECHNOPEDAGOGY AND METACOGNITIVE EFFICIENCY OF PUPIL TEACHERS

A

Synopsis

Submitted in partial fulfilment for the requirement of

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In

Education

Submitted by

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1.0.0 INTRODUCTION

Education plays a vital role in the sustainable development of our society as it provides a platform to the students for their own learning and gaining knowledge. As there is transformation in our style of teaching that is from autocratic teaching to democratic teaching and thereafter to laissez fare teaching. The teacher considers that principle of individual differences plays a vital role in the learning and performance of student. It involves the differences on the basis of ability, interest, attitude etc. Hence, the teacher of 21st century era has accepted the fact that they need to teach the student by the use of educational technology tools which will be as per the student's learning experience and individual differences. The present education system is facing challenges in terms of substituting the conventional methods of teaching. New methodology is needed to be adopted so as to resolve the problem of the past and giving knowledge to student as per the informative and modern society. Even we are getting the opportunities so as to upgrade our education system along with the technology.

As per the change, the teacher is also playing an active role whether in terms of philosophical, sociological or psychological basis. In the same manner the instruction type has also shifted from teacher centered to student centered. According to Ashby (1967) there are mainly four resolution in education.

- shift in education from parents to teachers that means from home to school
- adoption of written words as a tool in the field of education
- invention of printing because of which there is availability of books and study material
- the latest development in the field of electronics such as computer, radio and television

The wider use of Information and Communication Technology has led to change in the trend of teaching and learning era. Earlier the use of computer was to get some sort of information but as and when the technological feasibility was increased the use of computer brought flexibility in learning for the student as every machine cannot provide assistance to student for learning. As per the National Council for Teacher Education, the programme of education for teacher involves their research work, training of themselves so as to teach from pre-primary level to higher education level. For developing the proficiency and competency of a teacher it is essential to provide teacher education programme which will enable the teacher to work as per the requirement of the profession. It is said that the educational institution provides learning experiences which brings light of knowledge among the students. The key

role is played by the teacher for transforming the behaviour of students. The teacher acts as an essential and vital element in an educational institution. The teacher performs his/her role in the educational process. This indicates that by investing in educating and preparing the teachers, it would lead to a better future of a nation. UNESCO supports the use of technology in schools and they are exploring how the computers can help in solving the educational problems. It is also being addressed in the present time that without proper research and technical skills the students will still remain ill-equipped. The traditional system of education barely focused on the incorporation of technology in the field of education so as to engage the mind of the learner. The question arises how the teacher education program can train the teacher so that they can learn and become proficient in digital literacy? In the present era, it is essential that teacher education program should equip the teachers with the skills of ICT usage for their own professional development.

In our society, the degradation of teacher education quality can be considered in three ways and that are quality differentiation, quality scaling and quality perception. Variance is said to be the difference between the expected and actual quality of teacher education program. Even the reason for degradation is the level of entrance test which in quality conducted for the graduate, post graduate or doctoral level. Secondly, the reason can be considered that is role of private sector in education. It has been observed that time to time the expectations from a teacher goes on changing. They not only need to have the subject matter knowledge and pedagogical skills but are also expected to have leadership skills, thinking skills and communication skills. The traditional curriculum does not focuses on the expectation of the present generation. As the demand for up gradation of teacher education is increasing therefore the higher authority need to ensure that quality in terms of teacher education must be improved along with the outcomes as well. These challenges can be resolved by bringing Moodle in education.

The concept of learning community brought into limelight because of the development of Learning Management System (LMS). It became popular as a tool among educators as it helps in creating dynamic websites which is further useful for their students. Moodle stands for Modular Object Oriented Dynamic Learning Environment. It is one of the best Learning Management System in India. Though there are various other LMS as well like Desire@Learn, WebCT and Blackboard. Moodle was developed in the year 2005 by Martin Dougiamas and it was a part of his PhD (Moodle, 2005). Basically Moodle is based

on the philosophy which says that there is maximum control of instructor and minimal control of administrator (Moodle, 2010). Social constructivist pedagogy is said to be the Moodle which facilitates collaborative learning. Moodle is one of the LMS for the purpose of creating an environment which is constructivist as well as student-centered. According to Peter (2004), there are three main functions of Moodle and that are as a means of communication, as an authoring tool and as an administrative tool. Moodle as an LMS provides collaborative tools like discussion forums, email, virtual classroom and chat which provides assistance in learning. The main objective of Moodle is to provide learning environment to students as in the present scenario, people having good knowledge gets more importance which increases their competitive edge. There are variety of options which provides flexible learning as it has global reach, easy to manage, time efficiency, cuts costs and facilitates individualised learning instead of traditional one. However, we have seen that blending of two modes of education that is traditional methods as well as new technology tools is trending these days. If we talk in terms of positive learning outcome, it is observed that blended learning or integration of two modes has resulted in optimal learning. Using technology so as to fulfil the sole purpose of technology should not be the goal of any educational institution. Rather technology must be used as a tool for integration and it should also provide a platform for the purpose of achieving objectives and standards (Reigluth, 1999). Technology integration is helpful in the following ways:- It provides authentic materials, facilitates thinking skills, provides learner in-depth information and helps in knowledge construction. In context of distance learning, we can use technology as a standalone platform or can integrate with traditional classes that is blended or web-enhanced courses. Before selection of any technological tools for education the following points must be considered:-audience, goals of the class, communication type, objectives of the course, cost of the tools and return on investment. After keeping these points in mind the tool can be selected. The common tool can be selected in virtual learning are Moodle, Blackboard, WebCT, Sakai and Nicenet (Martin et al., 2008). Though Blackboard and WebCT provides wide range of functions but both are license based and expensive as well. The tools are meant for developing learning modules and courses rather than acting as learning methodologies. Nicenet is an internet classroom with limited amount of features. Moodle is an open source program which is available on server for the purpose of download. Proper knowledge is required so as to install, download and administer the program.

However, when once it is implemented further widgets are offered by Moodle which uses pedagogical approaches so as to create useful content for the learners.

There are mainly two ways through which Moodle can be installed that is either at web hosting company or at an organization's web server (Ahmad et al., 2012). According to Momani (2010), the Moodle features can be understood on the basis of the following factors: technical specification, course and curriculum design, pedagogical factor, administrative tools, learner environment, and instructor tools. Other than using Moodle as a tool there are other ways in which Moodle can be used and that are: - to use it at large deployment, to conduct online courses, to simplify face to face courses, to build collaborative communities of learning, to deliver content to learners, for example SCORM (shareable object reference model) package and to assess the student performance.

Moodle is said to be as the learning management as the versatile system for the course to be launched. There are number of developers who are focusing on the development of Moodle. In two ways there is development of Moodle which has taken place and that is flexibility and accessibility. Through open source software development model we can provide, maintain and improve Moodle as well and it is said to be as the e-learning software which provides the facility of knowledge sharing as well. It is said that at a low cost, the educator can collaborate and can develop an online-learning community by using pedagogical principles. With the help of Moodle an educator can provide different collaborative activities such as blogs, quizzes and assignments. Though the introduction of Moodle in the traditional classroom has to face lots of challenge. That can be described as technical support and human characteristics. Technical support involves installation, operation, maintenance, network administration and security while human characteristics involves age, technical know-how and gender.

1.1.0 Features of Moodle:

Table 1.1: Exhibiting the Features of Moodle

Easy to use	Moodle is helpful in teaching learning as it provides the facility of intuitive dashboard as well as of graphic user interface.
Most soughted	Moodle is said as the most soughted source in the form of LMS. It is used by educational institutions and organizations so as to provide training to the learner via online mode.
Endless features	Moodle comes up with endless features such as calendar, wikis, forum and chat. Even the links are provided to students so as to access the enriched content without learning the Moodle.

Customization	Moodle provides the organization the facility of customization in which a white labelling option is provided so that the style can be made aesthetic as per the requirement.
Facilitates learning	In comparison to the traditional classroom wherein there is limited time for the students to learn, while in Moodle student learn independently as they study online on their own.
Pedagogical approach	In present scenario it is been observed that educational software comprises of various features while they ignore the most important aspect that is pedagogy. Here, pedagogy will lead to cooperation and interaction among student and teacher.
Lead to community development	The people who are engaged in Moodle as an instructor and developer are from different parts of world.
Integration quality	Seamlessly Moodle has the quality to integrate with software such as GoTo, webex, wordPress etc. And the best feature is that a single sign in can be formed.
Social learning	In case of a regular course, the learner take up the assessment and do various other activity. But that becomes monotonous as the learner get stuck into it. But in Moodle some popular social tools are used such as share on timeline, likes and comments.
Micro learning	Short interactive course can be created with the help of Moodle, it is said to be the core of Moodle as it is super easy, customized and reused.
Mlearning	Moodle provides the app for the mobile phone in which the user can browse the courses and track learning progress etc. The customization facility is also provided to user just like the desktop version.

Following are the Features of Moodle when used as LMS: Wiki, discussion forum, assignment submission, online quiz, file download, instant mails, file upload, online announcement, online calendar, online news, grading and instant messages.

1.2.0 COMPARISON OF MOODLE WITH OTHER LMS

Table 1.2: Exhibiting the Comparison of Moodle with other LMS

Basis	**Moodle**	**OpenEdX**	**CanvasLMS**
Description	Moodle is a learning platform which is designed so as to provide educators, administrators and learners with a single robust, secure and integrated system for creating personalised learning environments.	The **Open edX** platform is open source learner management system (LMS) that was originally developed by **edX**. It is widely used all over the world so as to host Massive Open Online Courses (MOOCs) along with smaller classes and training modules.	It allows schools to build the digital learning environment so as to overcome the challenges faced by their institution. It is a powerful set of highly integrated learning products.
	https://moodle.org/	https://open.edx.org/	https://www.instructure.com/canvas/en-au
FEATURES			
e-Commerce	Yes	No	Yes

mLearning	Yes	No	Yes
Blended learning	Yes	No	Yes
Content Authoring tools	Yes	No	No
Offline learning	Yes	No	No
Custom user interface	Yes	No	No
SCORM Compliance (Sharable Content Object Reference Model)	Yes	No	Yes

The paradigm shift from traditional learning to e-learning has led to a change in the research field and had made a major impact in many educational institutions. We can use e-learning solely for distance education or we can consider it as supplement with classroom teaching. For supporting the e-learning process, a wide range of LMS have been developed. By using Learning Management System (LMS) in the field of education, one can enhance the teaching-learning process. Comber et al. (2010) conducted a study in which it was examined that whether the choice of LMS affects the learning process or not, for which a blended learning course was provided through three LMS that were CEWebS, Fronter and Moodle. It was concluded that successful implementation of blended learning depends upon the choice of an appropriate LMS that is e-learning solution. Learning through a LMS like Moodle that provides freely available features such as discussion forums, virtual classrooms, email, chat and blog features, will help researchers and educators for creating an effective online learning communities (Falleiro ,2013). A positive relation of LMS was found with students engagement, motivation and academic performance because of the features especially like Forum, Assignment, Chat and Quiz (Falleiro ,2013). Shanavas (2016), in his study found that learning through Moodle based Learning Management System (M-LMS) is more effective than conventional learning in Physics achievement. So it can be said that, as per the change in trend in technology the teacher need to change his/her teaching methodology as it will not only help in enhancing the teaching skills but will also improve the knowledge span of students. This will encourage pupil teachers as well as in service teachers to adopt innovative approaches of teaching.

2.0.0 EMERGENCE AND JUSTIFICATION

As per Verneil and Berge (2000), the online course helps the student to succeed as they allow them to be an active participant and also promotes collaborative learning (Berge, 1995; Susan and Kenneth, 1999). It is said that the student drives higher level of satisfaction from the course which is highly interactive in comparison to the course which is less interactive (Fulford and Zhang, 1993). As for the purpose of teaching, pedagogy plays a vital role because it not only improves the student's understanding but also the teacher's ability (Wernet, Olliges & Delicath, 2000). In context of technology, the latest pedagogical tool is web based course management system. For higher education, learning management system is considered important so as to maintain an appropriate academic system. There are various LMS available in the market but Moodle is considered as the most popular one (Suleiman, Umar and Abdu, 2012, Chew & Chitumbo, 2012). According to Moodle (2010), it is a course management system which has the quality of enabling delivery of online education. As per Ayse (2008), the pedagogical impact of Moodle can't be ignored. In the field of education either it can be used for providing an online course or for providing support to traditional face to face teaching. Due to its unique features i.e. flexibility, free availability, it is used at different level of education i.e. from primary school to university level. Moodle is said to be as an ideal e-learning environment for teachers as well as students (Britto, 2006). Some of the recent researches carried out in this field includes: Ziraba and Akwene (2020) has done a systematic literature review on the adoption and use of Moodle Learning Management System in which they have concluded that there are various factors which determine that whether to make the use of LMS or not and that too in developed and developing context. Hasan (2019) has discussed about the usefulness and usability of Moodle LMS in which it was concluded that there are nine usability problem faced by the students on Moodle interfaces. Chan et al. (2019) has found the impact of technology enabled learning that is Moodle on student perception. They concluded that students' were having higher level of satisfaction but there were challenges as well and that were insufficient infrastructure and lack of internet access in the classroom. Perapolchaikul et al. (2019) have studied about the students' attitudes towards the effectiveness of Moodle platform and they have suggested that Moodle provides support to the students' learning in Problem Based Learning curriculum. Papadakis et al. (2018) has evaluated Moodle use via smart mobile phones in which it was found that students

preferred to use Moodle on mobile phones as it was easy but they have also expressed about the need of more user friendly mobile access. Though Moodle a new instructional design is getting developed because of which the role of teacher is changing to. Despite the new changes in the field of technology, there is little research into how Moodle is actually being used in educational institutions. Though several international studies are conducted in the field of Moodle. Review of related researches reveals that there are lack of studies conducted in Indian education system on development of Moodle for a course useful for pupil teachers. E-learning can be enhanced with the help of Learning Management System (LMS) for which we require web interface. The challenging part of e-learning system is to assess and evaluate the knowledge of learner. Hence, with the help of supportive study it can be said that Moodle allows the instructor to assess them the activities to do. Even the instructor can conduct surveys so as to get students responses. Moodle provides tracking tool through which it can be finded out that what is the frequency of students who have access to course components. It allows the instructor to create self-assessment activities which will be used by learners and also allows the students to upload their assignments. Moodle helps the teachers to fully utilise its feature

in their teaching career. It also enables the teacher to interact with the students more effectively. As per National Education Policy 2020, “New technologies involving artificial intelligence, machine learning, block chains, smart boards, handheld computing devices, adaptive computer testing for student development, and other forms of educational software and hardware will not just change what students learn in the classroom but how they learn, and thus these areas and beyond will require extensive research both on the technological as well as educational fronts”. Teaching AI without the use of technology is not the right way of curriculum transaction. As a result it is found that the use of technology is not made in the right manner. It is the urge to change the way of curriculum transaction. A research will be vital to develop a Moodle in order to make learning of pupil teacher joyful along with enhancing their skills. This study is vital as it develops a Moodle by keeping in mind the new course introduced for pupil teachers. The pupil teachers can be trained in learning how to make use of Moodle

along with it they will learn the AI course in a self-regulated manner. The following figure shows the relation of Human Intelligence with Artificial Intelligence:

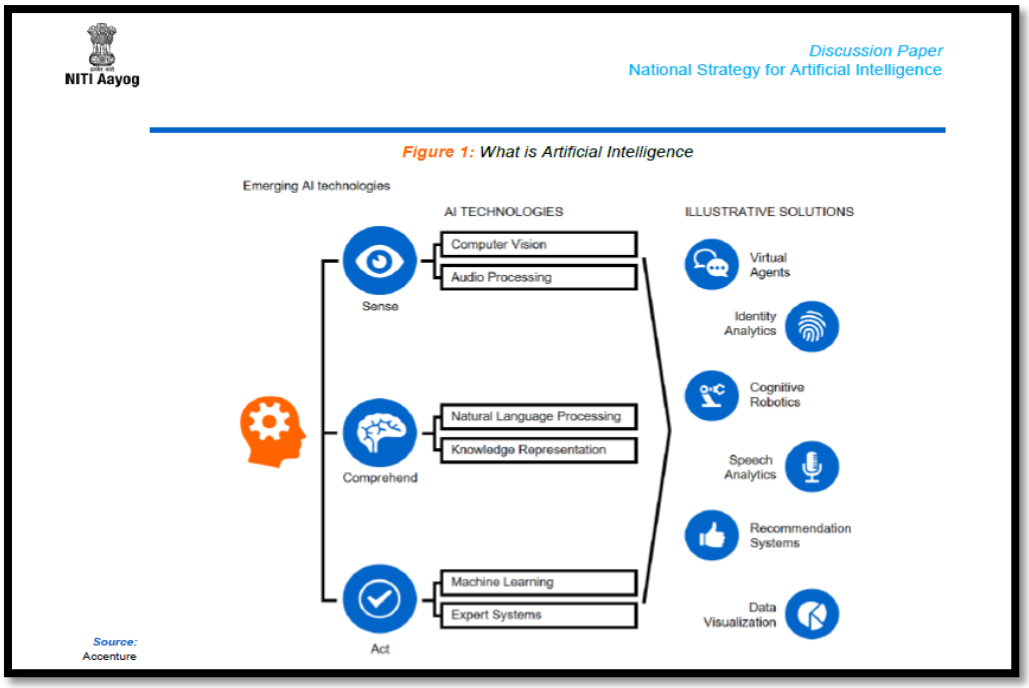


Figure 1.1: What is Artificial Intelligence?

Source: Discussion Paper titled "National Strategy for Artificial Intelligence" by NITI Aayog, 2018

AI is said to be as the collection of technologies that allows the machines to work with human capabilities that are sense, comprehend and act. Here, computer vision and audio processing can perceive the world around them by acquiring as well as processing images, speeches and sounds. The natural language processing and inference engines helps the AI system so as to analyse and understand the information which is collected. Actions can be taken through the use of technologies by an AI system such as expert systems and inference engines. By the ability to learn and experience one can augment the human capabilities. AI system is going to be used as a supplement of these capabilities. AI integration will help in meeting the national goals as NITI Aayog vision is skilling for the AI age- getting India ready for the AI wave. CBSE has announced to use Artificial Intelligence as a multi-disciplinary integrated approach so as to enhance teaching learning across classes 6 to 12. Though the presence of teacher is irreplaceable, but AI has changed the way of teaching learning process. We can understand the fivefold ways through which AI will bring the best learning outcomes among the teachers.

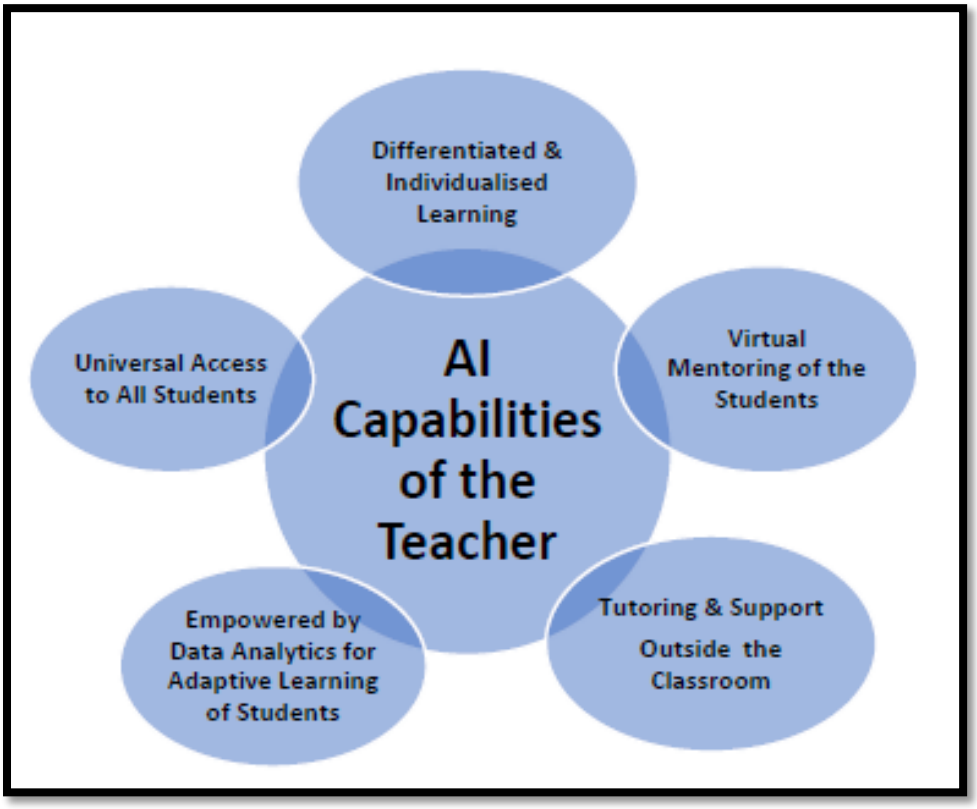

Differentiated & Individualised Learning
Universal Access to All Students
AI Capabilities of the Teacher
Virtual Mentoring of the Students
Empowered by Data Analytics for Adaptive Learning of Students
Tutoring & Support Outside the Classroom

Figure 1.2: AI Capabilities of the Teacher

Source: A Handbook by CBSE (2018) titled "Artificial Intelligence Integration across Subjects for CBSE Curriculum"

Previous researches and their findings raised some research questions such as:

1. Does instruction material based on Moodle has any effect on the digital fluency, technopedagogy and metacognitive efficiency of pupil teachers?
2. Can the weakness of the traditional method of imparting instructions be overcome by the instructional material based on Moodle?

3.0.0 STATEMENT OF THE PROBLEM

Effect of Moodle Based Instructional Material in Artificial Intelligence Course on Digital Fluency, Technopedagogy and Metacognitive Efficiency of Pupil Teachers

4.0.0 DEFINITION OF KEY TERMS

4.1.0 Moodle

Moodle is a large, web-based software package that enables instructors, trainers, and educators to create Internet-based courses (Dvorak, 2011).

The investigator considers Moodle as the learning management system which will be used for providing content, quizzes and assignments on AI course.

4.2.0 Artificial Intelligence

Artificial Intelligence is a branch of science which deals with helping machines find solutions to complex problems in a more human-like fashion (Johnson, 2020).

Here in the study the investigator has considered the AI term as a course studied by the pupil teachers.

4.3.0 Digital Fluency

Digital fluency is the ability to use digital media, of whatever sort, to manage knowledge and learning across diverse offline and online spaces (Baden, 2015).

In the present study, the investigator considers digital fluency as the effectiveness of handling and using Moodle by the pupil teachers.

4.4.0 Technopedagogy

Electronically mediated courses that integrate sound pedagogic principles of teaching/learning with the use of technology (Connors, 2001).

In the present study, the investigator considers technopedagogy as the skill of using the teaching ability along with the usage of technology.

4.5.0 Metacognitive Efficiency

Metacognitive efficiency is the level of metacognitive sensitivity expected for a given level of task performance (Fleming, 2014).

The investigator considers Metacognitive Efficiency as the extent to which the learner is aware about their own performance.

4.6.0 Pupil Teachers

In the study, the investigator considers the pupil teachers who are doing B.Ed. from Dayalbagh Educational Institute, Agra for the purpose of study.

5.0.0 OBJECTIVES OF THE STUDY

1. To make a content analysis of B.Ed. course paper of fundamental of Artificial Intelligence in education for the Moodle.
2. To develop instructional material for Moodle in Artificial Intelligence course.

3. To study the effectiveness of Moodle based instructional material as compared to traditional classroom lecture cum demonstration method.
4. To study the effect of developed instructional material on digital fluency of pupil teachers to use Moodle for Artificial Intelligence course.
5. To study the effect of developed instructional material on technopedagogy of pupil teachers to use Moodle for Artificial Intelligence course.
6. To study the effect of developed instructional material on metacognitive efficiency of pupil teachers to use Moodle for Artificial Intelligence course.

6.0.0 HYPOTHESES OF THE STUDY

$H_1$1: There will be significant difference in the effectiveness of Moodle based instructional material as compared to traditional classroom lecture cum demonstration method.

$H_1$2: There will be significant effect of developed instructional material on digital fluency of pupil teachers to use Moodle for Artificial Intelligence course.

$H_1$3: There will be significant effect of developed instructional material on technopedagogy of pupil teachers to use Moodle for Artificial Intelligence course.

$H_1$4: There will be significant effect of developed instructional material on metacognitive efficiency of pupil teachers to use Moodle for Artificial Intelligence course.

7.0.0 VARIABLES OF THE STUDY

Independent Variable: Developed Instructional Material

Dependent Variables: Digital Fluency, Technopedagogy and Metacognitive Efficiency

Extraneous Variables: The following variables will be controlled:

Table 1.3: Exhibiting the Extraneous Variables

Category of Variables	Variables	Controlling Techniques used	Methods of Controlling
Subject related variables	Age SES	Sample selection	Through Randomization
	Anxiety Motivation	Rapport establishment	By Researcher
Environment related variables	Classroom climate	Rapport establishment	By Researcher
	Noise	Removed	Psychologically By Researcher
	Light Test time	Constancy	By Researcher

	Test administration		
Sequence related variables	Practice	Eliminated	Psychologically By Researcher
	Fatigue	Eliminated	Psychologically By Researcher
	Cooperation	Constancy	By Researcher

8.0.0 DELIMITATIONS OF THE STUDY

The study will be delimited in the following ways:

1. The study will be delimited to Agra city only.

2. The study will be delimited to B.Ed. pupil teachers of Dayalbagh Educational Institute, Agra.

3. The study will be confined to only Artificial Intelligence course.

9.0.0 METHODOLOGY

The main objective of the study is to develop a Moodle based instructional material on AI course for the pupil teachers of Agra. For attaining the objectives the investigator will firstly develop a Moodle based instructional material on AI course. Further **quasi experimental design** will be used in which 'pretest, post test parallel group design' will be employed in order to draw the results.

10.0.0 SAMPLE OF THE STUDY

For this study pupil teachers (B.Ed. students) of artificial intelligence course will be treated as sample and number of sample units for pupil teachers is sixty. It will be divided into two equal half groups, one group will be considered as experimental group and second group will be considered as control group.

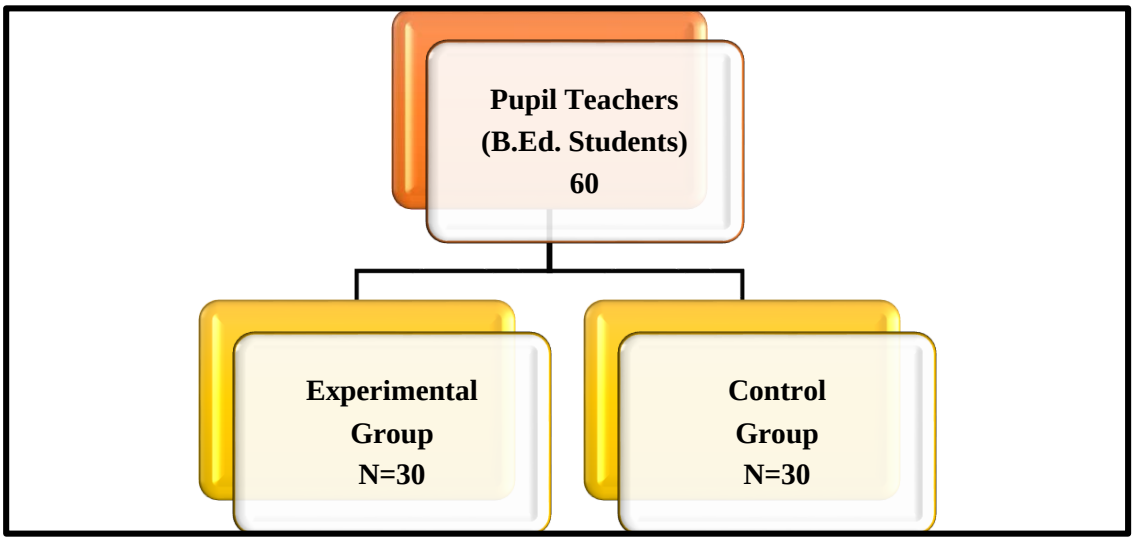


Figure 1.3: Sample of the Study

11.0.0 PROCEDURE AND DESIGN OF THE STUDY

The following procedure and design of the study will be followed:

11.1.0 Procedure of the Study

Procedure of the present study will incorporate following steps:

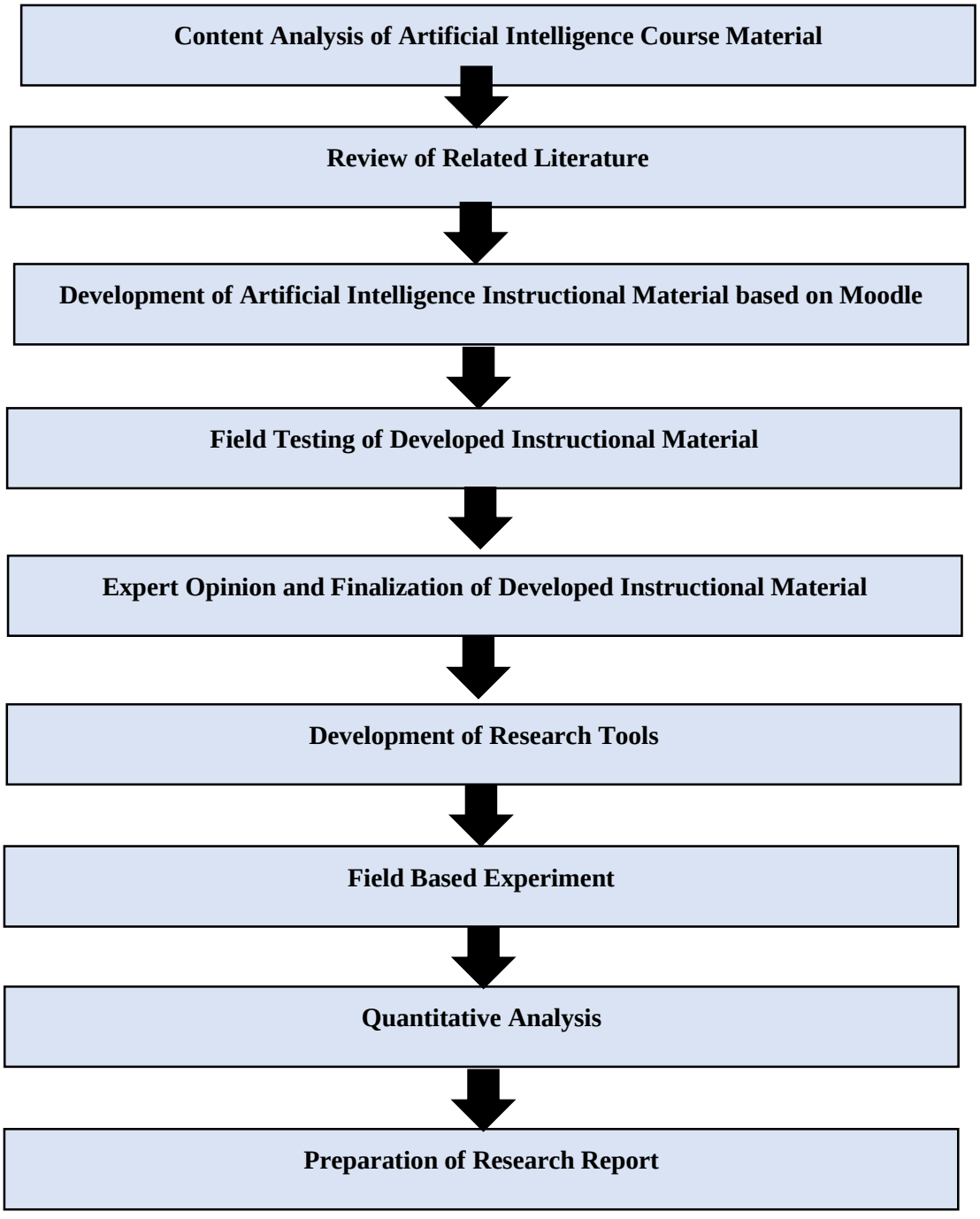

Content Analysis of Artificial Intelligence Course Material
Review of Related Literature
Development of Artificial Intelligence Instructional Material based on Moodle
Field Testing of Developed Instructional Material
Expert Opinion and Finalization of Developed Instructional Material
Development of Research Tools
Field Based Experiment
Quantitative Analysis
Preparation of Research Report

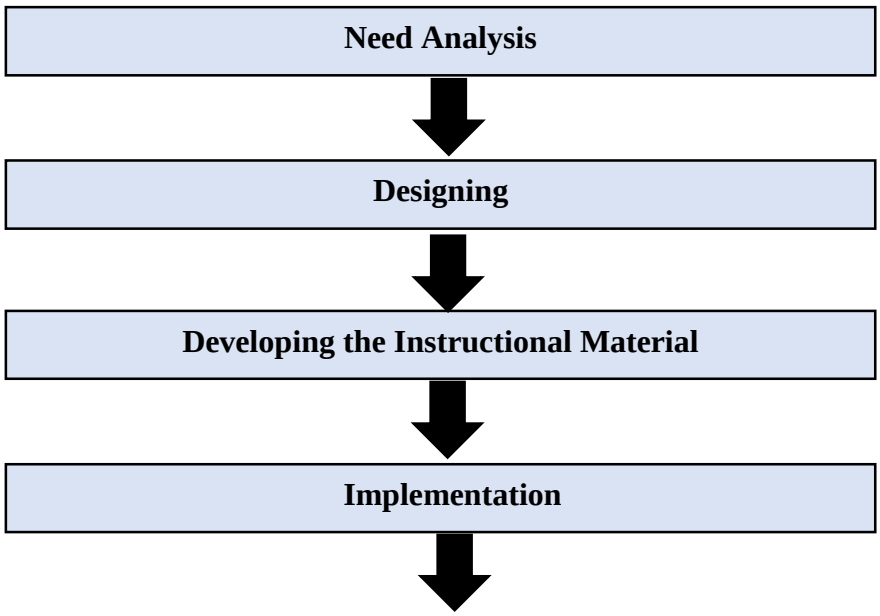
Figure 1.4: Procedure of the Study

Table 1.4: Exhibiting the Procedure of the Study.

S.N.	Steps	Details
1.	Content Analysis of Artificial Intelligence Course Material	The researcher will use content analysis as a research tool to determine the presence of certain concepts within some given text.
2.	Review of Related Literature	The researcher will do a detailed review of existing literature related to the topic.
3.	Development of Artificial Intelligence Instructional Material based on Moodle	Moodle based Instructional Material on Artificial Intelligence course will be developed by the researcher
4.	Field Testing of Developed Instructional Material	The researcher will do field testing so as to use selected instructional material with pupil teachers in order to better evaluate the potential use of the instructional material in the curriculum.
5.	Expert Opinion and Finalization of Developed Instructional Material	Based on Expert Opinion the finalization of Instructional Material will be done
6.	Development of Research Tools	Development in context of research work
7.	Field Based Experiment	Instructional Material will be implemented by the researcher in this phase
8.	Quantitative Analysis	Quantitative analysis will be done by using the statistical technique that is descriptive as well as inferential statistics
9.	Preparation of Research Report	Chapter-1 Introduction Chapter-2 Theoretical Overview Chapter-3 Review of Related Literature Chapter-4 Methodology Chapter-5 Analysis and Interpretation of Data Chapter-6 Summary of Findings, Conclusions and Suggestions

11.2.0 Steps for Developing Instructional Material

The researcher will develop an Instructional material based on Moodle which will be based on following steps:



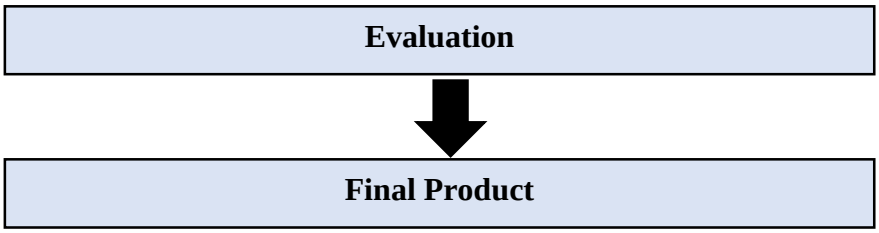


Figure 1.5: Steps for Developing Instructional Material

Adapted from Syatriana et al. (2013) Study

Table 1.5: Exhibiting the Steps for Developing Instructional Material.

S.N.	Steps	Details
1.	Need Analysis	Problem identification, solution, Teachers and students perception, review the existing instructional materials
2.	Designing	Teaching model, strategies, contextualization
3.	Developing The Instructional Material	Instructional materials writing, prototype, validation
4.	Implementation	Try out 1, revision 1, try out 2, revision2, etc. Formative Evaluation Instructional material production
5.	Evaluation	Summative Evaluation
6.	Final Product	Instructional material

11.3.0 Research Design of the Study

Two group pre-test and post-test designs will be used in the present study:

Table 1.6: Exhibiting the Research Design of the Study

<table>
<tr><th colspan="8">Phase I- Development of Moodle Based Instructional Material in Artificial Intelligence Course</th></tr>
<tr><th colspan="8">Phase II- Orientation and Implementation of Moodle Based Instructional Material in Artificial Intelligence Course</th></tr>
<tr><th colspan="4">Experimental Group</th><th colspan="4">Control Group</th></tr>
<tr><th>Sample</th><th>Treatment</th><th>Duration</th><th>Research Tool</th><th>Sample</th><th>Treatment</th><th>Duration</th><th>Research Tool</th></tr>
<tr><td rowspan="4">Pupil Teachers (N=30)</td><td rowspan="4">Orientation through Moodle based Artificial Intelligence instructional material</td><td rowspan="4">07 days (1 hour per day)</td><td>Academic Achievement test</td><td rowspan="4">Pupil Teachers (N=30)</td><td rowspan="4">Orientation through traditional approach based Artificial Intelligence instructional material</td><td rowspan="4">07 days (1 hour per day)</td><td>Academic Achievement test</td></tr>
<tr><td>Digital Fluency Scale</td><td>Digital Fluency Scale</td></tr>
<tr><td>Techno pedagogy Scale</td><td>Techno pedagogy Scale</td></tr>
<tr><td>Metacognitive</td><td>Metacognitive</td></tr>
</table>

			Efficiency Scale				Efficiency Scale
Phase III- Implementation and Assessment of Effectiveness of Moodle Based Instructional Material							
Experimental Group				**Control Group**			
Sample	**Treatment**	**Duration**	**Research Tool**	**Sample**	**Treatment**	**Duration**	**Research Tool**
Pupil Teachers (N=30)	Implementation of Moodle based Artificial Intelligence Instructional Material	20 days (1 hour per day)	Rating Scale towards the Effectiveness of Developed Instructional Material	Pupil Teachers (N=30)	Implementation of traditional approach based Artificial Intelligence Instructional Material	20 days (1 hour per day)	Rating Scale towards the Effectiveness of Developed Instructional Material
			Digital Fluency Scale				Digital Fluency Scale
			Techno pedagogy Scale				Techno pedagogy Scale
			Metacognitive Efficiency Scale				Metacognitive Efficiency Scale

12.0.0 DATA GATHERING TOOLS TO BE USED FOR THE STUDY

For the data collection following tools will be used by the researcher:

1. Academic Achievement Test

UNESCO's Glossary of Educational Technology Terms (1986) defined Achievement Test as "test designed to measure a person's knowledge, skills, understanding, etc. in a given area". Achievement in Artificial Intelligence will be measured by using an Achievement Test developed and standardized by the investigator for the study. The following steps will be followed for developing academic achievement test. The procedure to be followed and techniques to be used in the development of the test are described below:

Step 1- Planning of the Test

Step 2- Preparation of Blue Print
Step 3- Formation of Items
Step 4- Experts' Opinion
Step 5- Modification in Items according to Experts' Opinion
Step 6- Determination of Validity
Step 7- Try Out of Academic Achievement Test
Step 8- Item Analysis
Step 9- Determination of Reliability
Step 10- Scoring of the Test
Step 11- Final Draft of Academic Achievement Test

Figure 1.6: Steps in Construction of Academic Achievement Test

2. Rating Scale towards the Effectiveness of Developed Instructional Material (self-constructed)
3. Digital Fluency Scale (self-constructed)
4. Technopedagogy Scale (self-constructed)
5. Metacognitive Efficiency Scale (self-constructed)

13.0.0 STATISTICAL TECHNIQUES

By keeping in mind the objectives of the study, descriptive as well as inferential statistics will be used so as to find out the nature and distribution of scores to be obtained on a particular test. The following statistical techniques will be used for the study:-

1. Mean: Mean value will be calculated for the distribution of digital fluency scores, technopedagogy scores, metacognitive efficiency scores.

2. Standard Deviation: Standard Deviation will be calculated so as to study the variation in the scores.

3. t-Test: t-test will be employed for testing significance of the difference between the experimental and control group on the basis of pre-test post-test scores.

14.0 OUTCOMES OF THE STUDY

The National Education Policy (2020), has emphasised on learning outcomes (LO) for school students where they will have regular assessment instead of half-yearly/annual exams. With the aim to make the assessment and tracking of teaching-learning outcomes more transparent, it has been decided that a new National Assessment Centre, PARAKH (Performance Assessment, Review, and Analysis of Knowledge for Holistic Development), will be set up as a standard-setting body. Learning Outcomes indicates measurable skills, abilities and knowledge that the student demonstrates as a result of completing a given course, class or subject. Learning Outcomes describes what both the students have to learn and what the teacher will teach. Therefore it becomes essential for potential teachers to achieve their Programme learning outcomes. Just like Ministry of Education (MoE) has suggested Learning Outcomes (LO) in NEP, 2020 for school students in the same manner Programme Learning Outcomes (PLO) are suggested by UGC for pupil teachers.

14.0.1 PROGRAMME LEARNING OUTCOMES RELATED TO BACHELOR DEGREE IN EDUCATION

Following are the expected learning outcomes after doing the B.Ed. Course (UGC guidelines of Learning Outcomes Based Curriculum Framework, n.d.):

1. **Demonstrate core values:** such as commitment towards work, ensuring inclusion, showing sensitivity towards gender, cultural and religious difference.
2. **Development of Core competencies:** such as communication skills, working effectively with students and their parents and having the drive for achieving better student's learning outcomes.
3. **Demonstrate professional/technical knowledge:** here, prospective teachers need to have knowledge about development of students in terms of physical, social and intellectual aspect and how such development may affect their own learning.
4. **Demonstrate knowledge and understanding of strategies:** for differentiating teaching, teaching strategies that support active participation of students.
5. **Demonstrate knowledge required to design learning sequences and lesson plans**: planning and implementing well-structured teaching-learning programmes or lesson sequences that engage learners and also promote learning.

6. **Demonstrate professional competencies/practice for teaching strategies**: prospective teachers are required to select and use relevant teaching strategies so as to develop knowledge, skills, problem solving ability among students.
7. **Demonstrate professional competencies/practice for classroom activities**: teacher must have the ability to manage classroom activities by establishing and maintaining daily routines for the purpose of creating an environment where student time is spent on learning different tasks.
8. **Demonstrate professional competencies/practice for assessment:** it will help the teacher in developing, selecting and using formal, informal, diagnostic, formative and summative assessment strategies to assess student learning.
9. **Demonstrate competencies and actions for professionalism**: it is required for keeping teacher professionally engaged and provide them opportunity to participate in learning activities with the objective to update knowledge and practice, which are targeted to fulfill professional needs and school priorities.

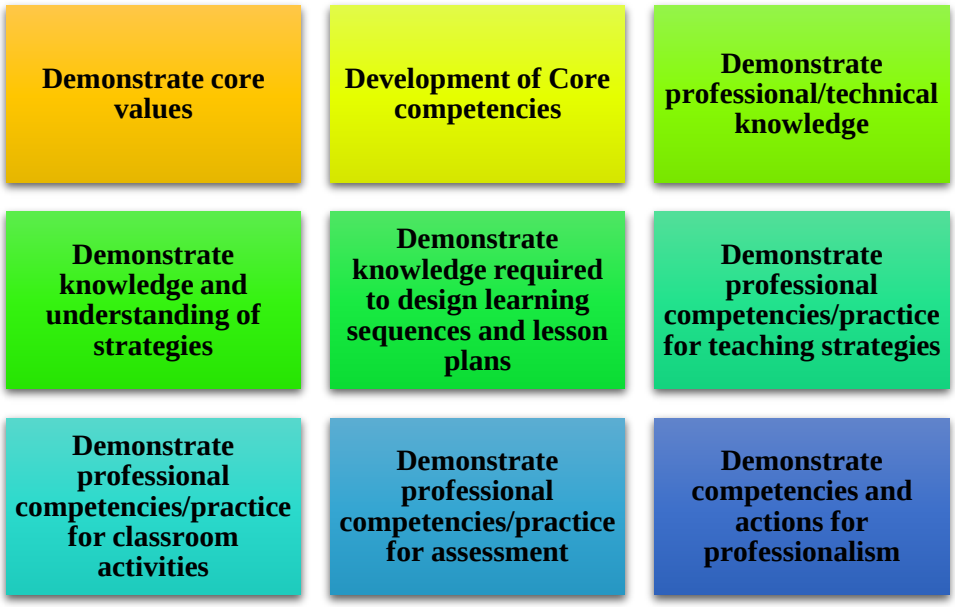

Demonstrate core values
Development of Core competencies
Demonstrate professional/technical knowledge
Demonstrate knowledge and understanding of strategies
Demonstrate knowledge required to design learning sequences and lesson plans
Demonstrate professional competencies/practice for teaching strategies
Demonstrate professional competencies/practice for classroom activities
Demonstrate professional competencies/practice for assessment
Demonstrate competencies and actions for professionalism

Figure 1.7: Learning Outcomes Based Curriculum Framework (LOCF)

By keeping into consideration the UGC guidelines of Learning Outcomes Based Curriculum Framework, the present study expects the following learning outcomes from pupil teachers:

1. **Development of Core competencies:** The present study will develop the core competencies of pupil teachers such as collaboration skills, ability to identify student needs and ability to use different teaching strategies.
2. **Demonstrate professional/technical knowledge:** Our research work will also provide technical knowledge to pupil teachers regarding the development and usage of Moodle.
3. **Demonstrate knowledge and understanding of strategies:** Further, this research will provide assistance to pupil teachers to integrate Moodle in offline learning.
4. **Demonstrate professional competencies/practice for classroom activities**: Assignments and Chat are two activities in Moodle that a teacher can use for engaging their students in learning activities.
5. **Demonstrate professional competencies/practice for assessment:** Pupil teachers will be able to use Quizzes in Moodle for evaluating student's understanding of content. Moodle will also help teachers in tracking, recording and assessing student's performance.

For our research purpose the expected learning outcome in Fundamentals of Artificial Intelligence in Education course is to understand the basic concepts of Artificial Intelligence and explore the applications of AI in various fields.

15.0 SIGNIFICANCE OF THE STUDY

E-learning is said to be an important teaching technique, there are different studies which are conducted on its impact on students' performance. The main aim of introduction of ICT in education has its own importance such as delivering instructions that can produce equal or even better outcomes than face-to-face learning systems (Saba, 2012). Along with the advantages there are disadvantages such as factors which negatively impact on students' performance. The e-classroom can be combined with the traditional techniques of teaching such as use of learning management system. The adoption and use of learning management systems depends upon certain factors and it differs in developed and developing contexts. Factors such as limited internet access, poor internet connectivity and lack of technological skills were the concerns that affects adoption and use of learning management platforms in the developing countries. (Ansong, Lovia Boateng, & Boateng, 2017; Hanif, Jamal, & Imran, 2018;

Ishtaiwa, 2011; Kilic, 2014; Oliveira, Cunha, &Nakayama, 2016). It is said that considerable amount of technological facilities are required for the use and adoption of learning management platforms. The view of Brazil and China's is on the challenges for LMS adoption while US view is that countries with abundant technological facilities and human resource still have issues with adoption and use of technology(Ziraba & Akwene,2020). The ongoing ICT-based educational initiatives and existing digital platforms must be optimized and expanded so as to meet the current and future challenges in providing quality education for all (National Education Policy, 2020). As per National Education Policy 2020, "Concerted curricular and pedagogical initiatives, including the introduction of contemporary subjects, such as Artificial Intelligence, Design Thinking, Holistic Health, Organic Living, etc. at relevant stages will be undertaken to develop these various important skills in students at all levels". The present study aims at the development of Moodle for enhancing digital fluency, technopedagogy and metacognitive efficiency. The result of present study will be helpful for pupil teachers, in-service teachers, administrators, policy makers, parents and educationist.

- **Importance to teachers:**

  Moodle can easily be integrated with other tools and systems such as the attendance tools, gradebooks and more. These integrations enables the teacher to spend less time enrolling and managing their learners and more time on teaching. Teachers have full access to build and facilitate a course in Moodle. They have the facility to add resources and activities, enter grades, change settings and configure the gradebook.

- **Importance to students:**

  Moodle provides access to learning materials anytime and anywhere. As Moodle is a web-based solution that offers a robust Moodle Mobile App, due to which learners can access course materials from anywhere and at any time. Hence, they don't need to be in the classroom and have physical materials on hand.

- **Importance to parents:**

  Moodle's standard Feedback activity allows parents or guardians to give their opinions on important school issues such as proposed curriculum changes. The parents can also witness that whether the learner is learning outside the classroom or not.

- **Importance to policymakers:**

  Moodle will be beneficial to policymakers for improving the teaching, learning and administrative processes in the education system and providing access to latest ICT tools to the students and teachers.

- **Importance to administrators:**

  Moodle enables the administrator to keep record of student's progress and to schedule tasks for the students. It will help the administrators in keeping the data safe and secured.

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